1 Introduction

1.1 Statement of Purpose

The purpose of this document is to serve as a Master Plan and management guide for the forestland owned by the Town of Weare found in the following parcels: Bartlett Brook, Chevey Hill, Eastman Lot, Felch Farm, Ferrin Pond, and the Poor Farm; a total of 2,088 acres. The major focus of this document is to identify trends and commonalities of all the properties, and the management goals, objectives, and practices that will be generally applied. In addition to this Master Plan, each individual property will have its own Management Plan specific to that parcel. Any deviations from this document will be noted in the individual management plans. The forest conditions, specific management goals and objectives, timber volumes, soil types, access considerations, special wildlife habitat considerations, historical information, recreation, easements and other specific details will be addressed on a parcel by parcel basis.

1.2 Planning Purpose

This document and the individual management plans being developed for each parcel will be used as a planning tool to guide all aspects of forest and non-forest management on the lands. The management plans for each individual parcel are designed for a 10 year period however they are meant to be dynamic in nature. As the science and knowledge base grows, as market conditions change, and as technology changes so must the management techniques. While the overall goals of management will remain consistent, the objectives and practices used to reach desired goals must be flexible.

Management on the Town of Weare forestlands will be geared to meet multiple, often interrelated goals and objectives. Even though economically and sustainably growing and harvesting trees is notably a major focus of ownership, timber is only part of the resource evaluated in the planning process. Water resource protection, open land, wetland and riparian conditions, wildlife habitat, recreational opportunities, scenic value, as well as renewable natural resource products such as biomass and fuelwood are evaluated and included in management recommendations. In the future the Town may choose to consider the potential for carbon storage in this age of global warming. Forest management on these lands will occur under the umbrella of land stewardship for the good of the forest and the people it serves.

1.3 Management Plan Development

Individual management plans for each property will be developed based on the goals and objectives specific that that parcel. A complete forest inventory was conducted as described in section 4.1 in this Master Plan. Inventory data is processed according to the specifics of each parcel and documented in the management plan. Parcel characteristics and recommended management objectives are described in detail based on the best current understanding of forest management.

1.4 Property Locations and Ownership History

The six parcels covered in this Master Plan are located in the town of Weare. The parcels have been acquired at various times and are managed under the direction of the Town's Conservation Commission.

All six parcels are considered and managed as "Town Forests". Town Forests are managed under the direction and auspices of the Weare Conservation Commission. All parcels are certified under the Tree Farm system.

2 LANDOWNER GOALS AND OBJECTIVES

Goals and objectives of management on the Town of Weare forestlands are:

1. The first goal of stewardship is to maintain the diversity of plant and animal life in the Town Forests so as to sustain ecological processes.
2. The second objective is to maintain a healthy and vigorous forest that can sustainably yield forest products.
3. Hunting, fishing, hiking, botanical observation, and wildlife observation are important functions of the Town Forests. The properties will be managed so as to maintain and enhance these recreational opportunities.
4. Maintain Tree Farm status

2.1 Ecosystem Management

The concept of ecosystem-based management is that the management process considers the elements of the surrounding environment. Ecosystem-based management views the land and the resource base in its entirety, as a holistic and integrated entity. Human beings are recognized as an integral part of ecosystems; in fact, social responsibility is a large part of ecosystem-based management.

Ecosystem management is a term which has been around for many years. The controversy over the spotted owl in the West renewed the interest in the concept. While management techniques often involve very large ownerships and management on the landscape scale, it can be applied to smaller ownerships as well.

Ecosystem-based management attempts to view the environment on a landscape scale and determine how ones management affects the intricacies of the surrounding landscape. During the

planning phase for any particular property, an exhaustive study is generally not done on the surrounding lands. Through the use of aerial photography abutting property is looked at. Often abutters are interested in participating in management activities. Property which boarders managed land, especially public lands may be a good place to try and work or plan cooperatively.

2.2 Green Certification

The newest movement on the road toward sustainable forestry and forest practices is the idea of green certification. In theory the idea is relatively simple, but in practice it is somewhat more complex. The idea is that forest practices meet a stringent set of guidelines set up and approved by a worldwide body, The Forest Stewardship Council. A third party, (Smart Wood in the case of The Ecosystem Management Company), certifies that the forest practices are meeting the guidelines. As a certified resource manager TEMCO's Managing Forester can bring certification to Weare's properties that meet the standards should Weare choose to do so. The forest products which are generated from certified woodlands can go into the market place with the "green label". Over time consumers will recognize that they do have a choice in the products they buy and some will choose the more environmentally friendly product. It is hoped that certified wood will bring a premium in the market place. As a parallel, it took some time for organic foods to gain a market share but it is now big business, and committed consumers often pay a premium for earth friendly products.

3 General Property Description

3.1 Landscape Characteristics

3.1.1 Geological Attributes

Physiographic Regions

Northern New England can be broken down into different physiographic regions, also called eco-regions. The regions are separated from one another based on a combination of climate regimes, topography, surficial geology, and soils. This in turn influences the plant and animal distribution in those regions.

Weare owns land in the one of three distinct regions found in the state, called the Vermont-New Hampshire Upland Section. According to the book Natural Communities of New Hampshire[1] this region includes the southwestern portion of the state involving slopes from maximum elevations of 2,200 feet down to the coastal lowlands in the southeast section of the

[1] Natural Communities of New Hampshire, Daniel Sperduto and William Nichols, 2004.

state. "It is a sloping plateau dissected by steep, narrow valleys and underlain by granite, gneiss, and schist." This Upland Section can be further broken down into four subsections, one of which is included in Weare's ownership, the Hillsboro Inland Hills and Plains. This particular subsection is characterized by "isolated hills and peaks of hard, resistant rock (mostly granite) commonly referred to as Monadnock. Numerous small lakes and narrow valley streams are scattered through the area. Drumlins are also distinctive glacial features. Soils are typically shallow and stony."

Topography

The present land formations were shaped by the most recent glaciation during the Pleistocene Era, which began approximately two million years ago. At that time all of Weare forestlands were covered by ice approximately 1 mile thick. The glacier receded 10,000 to 12,000 years ago and the forest began to re-grow. All of the topographic conditions encountered are affected by glaciation. Kames, drumlins, eskers and kettles are common geologic formations found on many of the properties and are the result of glaciation. Soil aggregations such as till and outwash are found on many of the properties.

Weare forestland properties range from low elevation relatively flat land in near the Piscataquis River to steeper and higher elevation land elsewhere. Elevation ranges from around 450 feet to about 1,100 feet at the highest point. Variability is wide and is discussed on an individual tract by tract basis.

Soils

Soils are the substrate upon which all trees grow. Soil is critical to productive tree growth, one of the primary objectives of the Weare ownership. Maintenance and consideration of the long-term productivity of the soil resource is critical to the sustainable production of forest products.

The threats to the soil resource include erosion or the loss of soil, compaction of the soil from heavy equipment, and nutrient loss. Measures to avoid these threats will include the installation of water bars where appropriate, seeding and mulching of exposed soil areas, the use of lower-impact logging equipment where necessary, logging on sensitive soils only when they are frozen, the retention of course woody debris and determining if and where whole-tree removal is appropriate.

Recommended actions to improve and manage the Soil Resource of the Weare's forestland include[2]:

[2] Soil management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

Forest soils, forest floor and Site Productivity:

- Avoid whole-tree removal, particularly on low-fertility sites (i.e., shallow to bedrock soils, coarse sands, wetlands, and area with high water tables), unless replacement of nutrients and organic matter is considered
- Conduct harvest operations during the season of the year that is most appropriate for the site. Operating on snow or frozen ground, whenever possible, minimizes effects of the soils and forest floor.
- Choose harvest equipment to suit the site and minimize disturbance. For example, in dry conditions, and in some wet conditions, consider using tracked vehicles to reduce rutting.
- Minimize skid-trail width using techniques such as bumper trees when appropriate.
- Establish skid trails that follow land contours where possible rather than directed straight uphill.
- When possible, conduct whole-tree harvests of hardwoods during dormant leaf-off season to retain nutrients on site.
- Avoid or minimize practices that disturb the forest floor, remove the organic soil or cover it with mineral soils, except as necessary to accomplish silvicultural goals and to regenerate certain tree species.

3.1.2 Brooks Ponds and Wetlands

Each property has its own water resources and hydrologic regimes including important water reservoirs for the Town. In addition to providing clean drinking water these areas contain critical habitat for many plants and animals and as a result are usually very diverse and productive. Forest management activities in these areas can have severe impacts if improperly applied. A main objective of management is to protect the water quality on the properties. On a case by case basis, riparian areas will be assessed for its degree of sensitivity to disturbance caused by forest management activities. Special management areas will be assigned to areas in and around water protection and ecologically sensitive areas.

Practices will be employed to minimize the effects of forest management on all water resources. These practices include but are not limited to; locating landings and skid trails to cause a minimum amount of disturbance and sedimentation, the use of permanently vegetated buffer strips, the use of uneven-age management systems in proximity to riparian areas, the retention of snags, trees with cavities and super-canopy trees, the maintenance of a uniform edge along major water bodies, and the total exclusion of timber harvesting in particularly sensitive areas.

Specific management recommendations for improving and managing the wetland and water resources of Weare's forestland include[3]:

Riparian and Stream Ecosystems:

- Establish riparian management zones along streams, rivers, ponds, and lakes. These are not intended as no-harvest zones. Forest management systems, such as single-tree or

[3] Riparian and Stream Ecosystem management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

small-group selections cuts, that retain relatively continuous forest cover in riparian areas (65-70 percent canopy cover) can help maintain biodiversity by protecting water quality, providing shade, supplying downed woody material and litter, and maintaining riparian wildlife habitat conditions.

- No-cut zones of 16 to 100 feet are recommended by several management guides on river or pond shores containing wet seeps, shallow or poorly drained soils, or area with slopes greater than 8 percent. Limited single-tree cutting can occur on other sites within this zone, with cabling from outside the zone suggested. (Elsewhere within the buffer light single tree selection shall be allowed. No roads or landings shall be created within the buffer. Existing roads to access the reservoir shall be maintained according the New Hampshire BMP's).
- Consider management at the watershed-level as an approach to avoiding stream channel degradation from excessive runoff.
- Road construction, stream crossings, skid trails, log landings, and all phases of timber-harvesting operations should conform to Best Management Practices

Springs and seeps:

- Avoid leaving slash in woodland seeps, springs, or associate wildlife trails.
- To the extent feasible, avoid interruption groundwater flow above or below seeps and above springs. When seeps and springs can't be avoided, minimize flow interruption by strictly adhering to appropriate Best Management Practices for water crossings.
- Where feasible, use woodland seeps and springs as nuclei for uncut patches to retain snags, cavity trees, and other site-specific features.

3.1.3 Natural Communities

Natural communities are aggregates of plants and or animals that are distinctive enough from one another to be separated. Certain plants are predisposed to grow on specific sites that offer a suitable habitat. For example, some plants grow on upland sites and others grow on wetland sites. In addition some, such as red maple and hemlock, are known as generalists and grow on both. While there are an abundance of different natural communities, a small percentage of them make up a large percentage of the land area. The less abundant, uncommon natural communities tend to harbor many of the rare and endangered species found in the region and will receive special attention.

Weare forest management planning will incorporate and map significant natural communities found on its property as they become known. Many forest managers are learning to identify indicator plant species which are crucial in keying out these communities, but the town may choose again, at some point to hire an expert in this field to do a more complete survey. Weare did hire the NH Natural Heritage Bureau to complete a property level survey of the Eastman lot in 2007. Once a natural community is identified, management will focus on growing trees which would naturally tend to be found on those sites.

Knowledge of natural communities can be very useful in the evaluation of non-timber related resources as well. For example, certain plants, birds, reptiles and mammals have

distinctive habitat requirements. By being able to distinguish one natural community from another a resource manager might be able to predict what might be found or what would make sense to manage for or perhaps where to look for rare or threatened species.

3.1.4 Rare Species and Unique Natural Communities

An in-depth flora and fauna survey is not within the scope of this planning process. The managers are becoming more familiar with threatened, rare, and unique species and the communities in which they may be found. The Natural Heritage Bureau reports of documented occurrences on and near Weare's forestlands are found in APPENDIX D.

3.1.5 Natural Processes

One of the goals of land stewardship is to consider and try to include the known elements of natural forest ecosystems during management activities. This is a difficult task because knowledge of undisturbed ecosystems is limited. Very little true old growth forest remains as a control for study. It is a certainty that true natural forests did not have anything extracted from them. Skidders most definitely are not part of the natural system. Certain natural processes can be sped up, slowed down, or enhanced through management. Some processes cannot be "managed" at all in which case nature rules. To consider these processes in management activities, it is important to identify and explore the major natural processes of succession, water and nutrient cycling, adaptation and disturbance.

<u>Succession</u>

This is a process which takes place naturally on any piece of land; be it forest, wetlands, open land and even developed land. Succession is the gradual displacement of one community of plants by another. The temporal scale on which this is viewed is important. On a geologic time scale phenomenon like glaciation, global temperature, and plate tectonics all play a role. On a much smaller time scale the succession from one plant grouping to another factors such as land-use patterns play the biggest role but natural disturbances, insect and disease infestations, fire and natural aging patterns also contribute to the change.

Forest managers rely heavily on the understanding that certain trees species are predisposed to grow in certain areas. In general, if allowed to develop naturally, a forest will develop from early successional shade intolerant species such as white birch, aspen and white pine to shade tolerant species such as hemlock, red spruce, sugar maple, beech and yellow birch. In 'tree life" an old aspen is 100 years while an old yellow birch is 500 years. Both wildlife habitat and the species that use a particular habitat change as succession progresses.

Wetlands provide a good example of how areas change over time through succession. Areas of open water over long periods of time become filled in, a process known as eutrophication. Bogs generally exhibit patterns of zonation where on the fringes it is wooded, then there is a zone of partially decomposed peat, and towards the middle there might be open water. Streams change course over time forming oxbows and new channels. They also erode deep ravines and change the topography over many years.

While every management decision cannot possibly be analyzed on every level, it is important to consider what the possible outcomes of a management decision might be. Through prudent consideration, management can be designed to achieve a set of desired results, including accelerating or retarding successional trends.

Water and Nutrient Cycling

The cycling of water and nutrients is crucial in maintaining the long-term stability of forested ecosystems. All types of vegetation including trees are involved in the process of nutrient and water cycling. The removal of all trees and other vegetation from a site would result in less water uptake and more runoff. Increased runoff often leads to the leaching of nutrients from the soil into streams thereby changing the down stream water chemistry. Many nutrients are sequestered in the trees and vegetation. The inevitable result of the removal of vegetation from a site is a loss of some nutrients. How water and nutrients are “managed” has an important implication for forest productivity.

Most of a tree’s nutrients are concentrated in the leaves, limbs and branches. The bole of the tree has relatively few reserve nutrients. There is concern that whole-tree harvesting can remove nutrients from a site because the entire tree is removed from the site. In a thinning situation where only a percentage of the trees are removed nutrient retention and recycling is impaired but not to the high degree found in heavily or clear-cut areas. In clear-cut or when whole tree methods are employed on the same area time after time the potential for nutrient loss is real. Soil types and site characteristics influence nutrient status and leaching as much as the vegetation. Dry sandy soils or thin soils on high elevations and ridgelines are inherently low in fertility and are also prone to rapid leaching.

Adaptation

A plant’s ability to adapt to a site or region over time helps it survive in an ever changing world. Further, the passing of genes from one generation to the next allows the best adapted individuals to thrive. Trees which are expressing themselves well are usually well adapted to their environment. An example is the ability of red spruce to withstand the harsh growing conditions on heights of land with shallow, thin soils and extreme weather events. Red spruce

has adapted to this environment over thousands of years and can survive in these conditions where other species, such as sugar maple, cannot. Well adapted trees should be encouraged through management decisions favorable to them. While the genotype (genetic make-up) of individual trees or stands of trees is not practical to determine, their phenotypes (the observed condition) are readily apparent. Therefore encouraging trees that appear highly vigorous and free from defects and disease is a way to ensure the best adapted individuals pass their genes on to their offspring.

Disturbance

All natural systems are susceptible to disturbance; forests are no exception. Forest scientists often refer to 'gap openings' in forested areas. These gaps are created by disturbance. Ice storms, fire, micro-bursts of high winds, hurricanes, floods, long-term weather patterns and insect and disease outbreaks, and human activities all affect forests. One of the greatest disturbances known involves the asteroid struck the southwestern United States 60 to 70 million years ago, changing the climate of the planet and leading to the extinction of many species including the dinosaurs. The most recent great disturbance occurred approximately 12,000 years ago when all of New England was covered by ice averaging a mile thick. When the glacier first retreated, the landscape resembled the arctic tundra. More recent disturbances are often responsible for creating a multi-age structure to a natural forest. A small area of blow-down created by a micro-burst will often regenerate to intolerant species thereby setting back succession. When allowed to recover without human influence, a disturbed forest will grow back with a more complex structure than it had before.

No discussion about disturbances would be complete with out considering human impacts. Debate over whether human influences are natural or not are best left for another venue. Suffice it to say that human disturbances in recent history have done more to influence the present state of our forests than any post glacial natural event. Human disturbances that influence the forest include: population expansion, land-use choices, fire, pollution and the introduction of exotic species.

In the 300 years since European settlement practically all of the forests in New England have been cut. Some areas have been cut five or more times. Early on, much of the land was cut, stumped, burned and used for agrarian purposes. The soils were depleted due to overgrazing and a lack of attention to water and nutrient cycling. Recently, population pressure is leading to the conversion of vast amounts of forest and agricultural land for development. This paving of the forest land eliminates natural processes for the foreseeable future. In addition, air pollution, acid deposition and global warming pose real threats to our forests. The introduction of Chestnut blight and Dutch elm disease essentially extirpated those species from our forests.

The introduction of non-native invasive shrubs that are commonly used in landscaping into our forestlands is posing a serious threat to natural succession. Invasive shrubs quickly take over the forest floor essentially impeding new age classes of native trees, shrubs, and herbaceous plants. The result could be disastrous: the conversion of naturally diverse forest ecosystems to mono-cultures of invasive shrubs such as Japanese honeysuckle (Lonicera japonica), common and glossy buckthorn (Rhamnus cathartica and Frangula alnus), barberry (Berberis vulgaris), Oriental bittersweet (Celastrus orbiculatus), and burning bush (Euonymus alatus). More information on invasive shrubs and what can be done about them can be found in the individual tract management plans.

An example of a relatively recent fairly wide spread disturbance is the ice storm of January 7th through the 10th, 1998. While it appears that this was a natural event the changes in our weather patterns due to global warming causes one to ponder if this was truly a "natural" event. This significant three-day weather event had conceivably done more to impact the forests of northern New England and New York than anything else in the past 100 years. While natural disturbances are fairly common in the life of a forest, this event was widespread and damaging to the trees in its path. On the whole Weare properties were spared the severe damage that other ownerships incurred.

It has been said by those who remember that region wide the damage was greater than the 1938 hurricane, the last weather event that severely damaged forests in such a large area. Research has revealed that approximately 17 million acres of forest land in Maine, New Hampshire, Vermont and New York were affected. Of that area, 5 million acres sustained what was termed "severe damage".

The degree and severity of damage to individual trees was quite variable. Species, crown size, form, and position on the landscape all played an important role. Crown loss or damage was the highest in a band which runs from approximately 1900 feet in elevation to 2200 feet. Within this area approximately many trees sustained some sort of crown damage. The larger trees with more surface area were the most vulnerable. Beech, yellow birch, and sugar maple respectively were particularly susceptible to ice loading. The smaller and more fragile white birch were often bent but not broken. Some of the red spruce and balsam fir survived the ice loading only to be snapped off in strong winds which followed the storm. At both lower and higher elevations damage was evident on many trees, but it was not quite as severe.

Individual trees responded to ice loading in different ways. Some of the trees lost a portion of their fine branches, while other trees lost their entire crown. Certain trees, especially red spruce, snapped or split leaving a stub instead of a tree. Some root structures gave way under the weight of the ice, and the trees simply collapsed.

Contrary to initial thought, most damaged trees have recovered very well. Trees that sustained 75% or more crown damage were thought not able to recover, but in fact many have recovered well.

Still, from an ecological standpoint, the ice storm had long-term, landscape level effects in the areas of forest development, structure and composition, wildlife habitat and nutrient cycling. The ice storm has made the forest more diverse in both species composition and age class structure. Areas with heavy storm damage responded differently than areas where the damage was not so severe.

A more diverse forest has many more niches for biological development. This increased complexity leads to a wide variety of species. In areas of significant disturbance, the most severely damaged trees will begin to decay and rot. As the dead and dying trees decompose, the abundance of snags will dramatically increase. An increase in wood boring insects will be followed by an increase in woodpeckers and other insectivores that will excavate cavities for other birds and small mammals. As limbs and broken tops of the trees begin to decompose, nutrients will leave the wood and leach into the soil. Some nutrients will be recycled further as the snags begin to fall and decompose. The cycle of the forest is thus a continuum consisting of many inter-relationships.

3.1.6 Climate

Air Map[4] with a website on Mapping New England's Changing Climate and Air Quality sums up New England climate as such: "As a result of New England's position relative to the polar front, its continental climate type, its coastal orientation, and the mountainous topography, the region's weather is notorious. It is known for its diversity over short distances and changeability in a matter of minutes. New England has recorded temperatures up to 107 ^{o} F and down to -50^{o} F (Ludlum, 1976). The high is hotter than the all-time high temperatures ever recorded in Miami, Florida or Atlanta, Georgia. The low is colder than the record low temperature in Anchorage, Alaska or International Falls, Minnesota - which is commonly the coldest location in the conterminous United States. The region also has rainstorms that rival those in the southeastern United States."

Another climate website[5] provides a nice summary of the local climate of Henniker/Weare. Weare, NH climate is mild during summer when temperatures tend to be in the 60's and extremely cold during winter when temperatures tend to be in the 20's.

[4] http://airmap.unh.edu/background/ClimatePrimer.html
[5] http://www.idcide.com/weather/nh/henniker.htm

The warmest month of the year is July with an average maximum temperature of 87 degrees Fahrenheit, while the coldest month of the year is January with an average minimum temperature of 13 degrees Fahrenheit.

Temperature variations between night and day tend to be moderate during summer with a difference that can reach 19 degrees Fahrenheit, and moderate during winter with an average difference of 17 degrees Fahrenheit.

The annual average precipitation at Weare is 46Inches. Rainfall in is fairly evenly distributed throughout the year. The wettest month of the year is July with an average rainfall of 4 Inches.

3.1.7 Historic Land Use

A brief and interesting history of Weare can be found on the website:

http://cowhampshire.blogharbor.com/blog/_archives/2006/3/20/1831687.html

3.1.8 Proximity to Conserved Lands

Many tracts and larger blocks of land are conserved in and around the Town of Weare. Largest among them is the federally owned Everett Flood Control land (For map of Proximity to Conserved Lands see Appendix E).

3.2 Wildlife Ecology

3.2.1 Habitats

The American Heritage Dictionary defines habitat as "The area or type of environment in which an organism or ecological community normally lives or occurs". Wildlife habitat takes on many different forms. The components of habitat - *food*, *water*, *cover* and *spatial relationships* - are all interrelated.

Food for animals takes on many different forms. Herbaceous plants, woody plants, hard and soft mast or nuts, fruits and berries, insects and grubs, prey, and carrion are all eaten by wildlife. The location and abundance of food sources plays a primary role in determining the quality of the habitat for any species.

Water is required by all living things. Standing water, running water, seeps and springs are all used. Some animals only periodically use water, while others live in and around it. Wetland habitats are known to be among the most productive for wildlife.

Cover is analogous to a human's home. Cavities in trees, brush piles, nests, ledge outcrops, dense softwood cover and holes in the ground are used to provide cover for different animals.

Spatial relationships, or patterns, tie the habitat components together. If all the habitat requirements of a particular species are found within its "home range", the animal will probably remain in the vicinity. Creating the proper juxtaposition of food, cover and water is important for wildlife to be attracted to, and perhaps remain in a particular area. Travel corridors are used by many species traveling from one habitat type to another. Ridgelines, streams and riparian areas commonly serve as travel corridors.

3.2.2 Habitats Types

Due to Weare's diverse land base it has many different habitat types. Primarily Weare owns forest land but there are also extensive wetlands, reservoirs, and a variety open land types. The New Hampshire Wildlife Action Plan describes the different habitat types in New Hampshire and also provides GIS mapping of these types. According to the Wildlife Action Plan, the dominant habitat types on Weare lands are Hemlock-hardwood-pine and Appalachian oak-pine. Several wetland communities occur including marsh and shrub wetlands, peatlands, vernal pools and a small amount of floodplain. Grasslands also occur. Detailed descriptions of these communities can be found in Appendix B.

Forested habitats are described on a stand-by-stand basis in the data section of each plan. Vegetation can be manipulated to provide or create certain habitat components. When vegetation is cut or planted to improve or create certain habitat types some species will benefit, and others will not. Often, habitats not found within the boundaries of an owners land can be found on adjacent properties. An in-depth analysis of adjacent ownerships is not usually done, but across boundary management will be considered when opportunities arise.

3.2.3 Forested Habitat Use

Weare's forest lands are richly varied and, if managed with an eye towards habitat improvement, can be even more so. As with a lot of land in New England, most of the overstory trees on the ownership are between 70 and 90 years old. With a more balanced age class the ownership can provide habitat for a multitude of species.

The upland hardwood areas attract species which browse, including deer and moose. Some of the tracts are under intense browse pressure, while others suffer little. The larger properties show signs of bear use.. All the forests support habitat for small mammals such as squirrels, weasels, mice, and voles. Turkeys feed on the abundant acorn source found in many

of the forests. Barred owls are common, and utilize heavy mature woods with nearby open country for foraging. Likely coyotes could be encountered on each parcel. Many resident and Neotropical birds will also use these upland areas. Birds such as the red-eyed vireo, white breasted nuthatch, chickadee, hermit thrush and various woodpeckers use these areas.

Softwood areas, especially along riparian zones are used by many species. Furbearers which require cover and water are likely to be present. Mink, otter, fisher, beaver and ermine could all be expected. Some of these areas are used as “deer yards", a place where deer tend to congregate during years of heavy snow. Heavily stocked softwood stands with a closed canopy provide shelter from the cold and from snow. Raccoons, red and grey fox and black bear all depend on softwood areas. Commonly, softwood areas in riparian areas are used as travel corridors for many species.

Forest areas of particular value to wildlife include: aspen stands, stands that contain hard mast including beech, red and white oak, hickory and hophornbeam, stands that contain soft mast including black cherry, mountain ash, apples, and service berry, and deer wintering areas. An effort will be made to adjust the age-class distribution to create a wider variety of habitats including the creation of ecotones (the transition zone between two adjoining communities) with maximum utility. Special consideration will be given to areas of high value (or potential high value) to wildlife.

3.2.4 Wetland Habitat Use

In terms of resource value and diversity, riparian areas exceed all others in importance. The areas around streams and other wetland sites provide very valuable habitat including breeding and nesting sites for many species. Riparian areas also filter runoff thereby keeping the water clean. As was previously mentioned, riparian areas are often used as travel corridors for animals moving from one habitat to another.

Most of the wetlands are located in depressions formed by glaciation. Beavers have flooded many of these areas over time, creating impoundments of water. The beavers come and go, periodically moving as the availability of food sources change. When beavers abandon a site water levels drop and often open wet meadows result. These forest openings are very valuable often making up a large percentage of non-forested openings on a property. Wetland habitat is also important for amphibians and reptiles, water fowl, great-blue herons, mink, otter and moose.

3.2.5 Open Land and Edge Habitat Animal Use

Non-forested habitat is a very important component for many wildlife species. Some such as the bobolink and the meadowlark spend their whole life in open land. Birds such as the woodcock need open land for roosting and mating rituals. Many animals including white-tailed-deer and black bear eat grasses and other herbaceous growth especially in the spring. Birds of prey hunt for mice, voles and other rodents in these openings.

Open land on Weare properties consists of agricultural fields, power lines, old fields in various successional stages, access roads and log landing areas. The amount of open land is continually decreasing to re-forestation.

The periodic mowing, brush cutting or other methods will be required to maintain these valuable openings where possible. Truck landings make good open land habitat and should be maintained as such. Proper closure of sites following logging will include grading, seeding and the installation of erosion control devices. The landing areas should be evaluated once every 3 years to determine their condition.

3.2.6 Habitat Management Approach

Two approaches to wildlife habitat management are commonly applied. The *featured species* approach caters to one or two chosen species. Management specifically for white tailed deer or for ruffed grouse are examples.

The *species richness* approach to habitat management will be applied in general on Weare's forestland. This management technique attempts to provide habitats for as many different species as a property can support. Ownership-wide there are already many habitats and they are used by many species. The species richness approach encourages a diverse, healthy ecosystem. One of the principles of management on Weare forestlands is to "support indigenous habitats and prevent fragmentation so that wildlife can migrate for seasonal food and reproductive needs". Wholesale manipulation of portions of the forest to benefit a particular species will be discouraged unless it makes sense on the landscape level. While certain management practices will be beneficial to some species and detrimental to others, the overall goal of management is to create a rich and diverse environment for wildlife.

Certain wildlife practices will be routinely followed during logging operations. An example of this is the practice of reserving or creating dead or dying snags where they do not endanger loggers or aesthetic values. Snags are very important to many species, especially birds and insects Birds excavate the cavities for many species to use. Another practice which will be followed is to leave as much existing and some new coarse woody debris on the ground as possible for use by insects, invertebrates and fungi. Course woody debris should include large

diameter low-value existing trees or those which are cut and left in place in the woods following cutting. These large pieces of decomposing wood are important for nutrient cycling, water retention and microbial activities. Black bears often work these logs over looking for grubs. This course woody debris is a component of the natural forest and contributes to ecosystem function. An excellent resource, *Biodiversity in the Forests of Maine*[6] (it serves equally well for New Hampshire forestland) recommends several wildlife habitat management suggestions including:

Snags, cavity trees, and down logs:

- Avoid damaging existing downed woody material during harvesting, especially large (16"+) hollow logs and stumps.
- Leave downed woody material on site after harvest operations when possible.
- Leave several sound downed logs well distributed on the site, where possible. Especially important are logs >12 inches dbh and > 6 feet long. Hollow butt sections of felled trees are also good choices.
- Create additional snag trees by girdling large cull pine where possible. Attempt to retain or create a minimum of 4 secure cavity or snag trees per acre, with one exceeding 24" dbh and three exceeding 14" dbh. In areas lacking cavity trees, retain love trees of these diameters with defects likely to lead to cavity formation.
- Retain as many live trees with existing cavities and large unmerchantable trees as possible.
- When possible, avoid disturbing cavity trees, snags, and upturned trees roots from April to July to avoid disrupting nesting birds and denning mammals.
- Retain trees with cavities standing dead trees, downed logs, large trees, and large super canopy trees in the riparian management zone to the greatest extent possible.

Habitat Connectivity:

- Avoid harvests that isolate streams, ponds, vernal pools, deer wintering areas, or other sensitive habitats
- Maintain the matrix of the landscape in relatively mature, well-stocked stands. Where even-aged management is practiced, consider the cumulative effects of multiple cuts and include wider habitat connectors as necessary.
- Consider opportunities for coordinating habitat connectivity with other, on-going land-management efforts that maintain linear forested ecosystems, such as hiking trial corridors and natural buffer strips retained to protect water quality. This may require expanding the physical size of the connector habitat and increasing structural values to fulfill multiple management goals. Also consider the potential for effects that may arise because of incompatible uses (e.g., heavily-used ATV or snowmobile routes around and through deer yards).

Deer Wintering Areas:

- Identify dense stands of mature softwood as potential DWAs, particularly in riparian ecosystems.
- Whenever possible, schedule harvests in DWAs are during December through April.
- Protect advance conifer regeneration during timber-harvesting operations.
- When conducting harvests in coniferous forest adjacent to watercourses, maintain an

[6] Wildlife habitat management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

unbroken conifer canopy along shorelines to protect riparian travel corridors.
- When planning harvests within any DWA, (strive to) maintain a closed-canopy coniferous overstory over at least 50 percent of the area at any given time. Avoid constructing major haul roads within DWAs.

Beaver influenced ecosystems:
- To the extent possible, locate new roads where they will not be at risk from flooding by beavers, or provide a base for the construction of new dams.

Vernal Pools:
- Identify and mark vernal pool edges in spring when they are filled with water to prevent damage during harvests conducted when pools are difficult to detect
- Avoid any physical disturbance of the vernal pool depression.
- Keep the depression free of slash, tree tops, and sediment form forestry operations.
- Maintain a shaded forest floor, without ruts, bare soil, or sources of sediment, that also provides deep litter and woody debris around the pool. Avoid disturbing the organic layer or drainage patterns within the pool watershed.
- Whenever possible, conduct harvests when the rough is frozen or snow covered.

3.2.7 Future Potential

Careful management and a solid stewardship ethic will allow Weare's forestland to provide excellent wildlife habitat for as long as the forest exists. Future management will work to highlight and enhance natural and man-made conditions. Apple trees will be released and pruned where feasible, healthy beech, oak and other mast producing trees will be encouraged to develop large crowns, snags, den trees , raptor nest trees will be retained, and wetland areas will be protected. A diversity of age classes will be allowed to develop. Young regenerating stands will complement the older growth trees in any reserve areas and along the streams and wetlands. Areas reserved from timber cutting will serve to provide a habitat type thereby increasing biodiversity lacking on many properties. A reserve area is a place without active management. It is a place where nature is allowed to take its own course. The only man-made disturbance might be a brook crossing or a walking trail. All landings and other areas of exposed mineral soil will be seeded with a conservation mixture after use. The ownership has all the components, including the most important, landowner commitment, to provide a rich, diverse habitat for generations to come.

Finally, the most powerful tool for ensuring the long-term existence of habitat is the conservation easements in place on many of the properties. Precluding development will do more to protect wildlife and their habitat over the long run than any vegetative manipulation.

4 Management Strategies

4.1 Inventory

The forest inventory was conducted to evaluate the various timber types, natural community relationships and wildlife habitats on the property. The forest inventory is also used to evaluate the historical archeological structures, terrain features, non-timber forest products, stocking and composition of the forest, to measure the extent and the severity of any damaging agents, and to estimate the growth rates and the volume of the timber on the woodlot. Further ground-truthing of the aerial photos is done during the timber cruise as well.

The general procedure is to systematically sample the forest using a variable plot radius. A 20 BAF prism is used to sample all stems 5.5 inches and greater in diameter and a 5 BAF prism is used to sample trees between 2 and 5.5 inches in diameter at each point. The trees which fall within the sample at each point are recorded by species, diameters to the nearest inch, crown position, and tree condition. Trees 6 inches and greater in diameter are tallied as veneer, sawlogs, pallet, pulpwood or growing stock. Merchantable stems are estimated in multiples of eight feet. Hardwood sawlogs are estimated to a 10 inch small end diameter except for white birch which is estimated to a 7 inch top. Softwood logs are estimated to an 8 inch small end diameter except for spruce of fir which is estimated to a 5 inch top. Pulpwood is estimated in eight foot lengths to a 4 inch tip. Each 8 foot section can be graded as veneer, sawlog, pallet, growing stock, pulpwood, or cull. Tree condition categories include *acceptable growing stock*: those trees that are capable of producing a high quality sawlog and are in vigorous form, *high risk*: those trees containing a high value product that will lose value if left to the next cutting cycle, *legacy trees*: trees with important biological legacy value and *unacceptable growing stock*: those trees that are low quality and/or have poor vigor.

Standing dead trees and down logs are also counted with the prism and tallied by species, diameter, and condition. Standing dead trees are counted while tallying live trees. Down logs are counted with the prism 4.5 feet from the largest end. There are three condition categories including sound, moderately punky, and punky throughout. As further science becomes available this information can be used as a measure to benchmarks established for natural forests. Additionally, presence or absence of cavities is recorded on all trees (snags and live).

Regeneration is considered to include everything from seedling size up to 2 inches in diameter (including shrubs). Regeneration is tallied within a hundredth acre (12 foot radius) plot taken at the point center. The plot is broken down into 4 quadrants. Each species present within each quadrant is tallied including its level of vigor and browse condition. The species is considered “stocked” if it meets at least one of three stocking levels including 2 stems between 0.5 and 1.5 inches diameter, 5 stems between 3 and 5 feet tall, or 25 seedlings less than 3 feet tall. If a species is present but does not meet

one of these conditions, it is recorded as unstocked. These stocking levels were derived from the best scientific literature available. Regeneration requirements vary depending on site, species, and competition and have yet to be specifically defined.

At each point, there is opportunity to gather additional information, including broad forest type, broad regeneration condition, browse impact, presence and condition of invasive exotic plants, natural community, plot photography or to take general plot notes.

In order to more accurately determine volume, the forest is divided into management stands. The stands are separated from each other because they differ from one another in size, species composition and or density. These are determined in advance from aerial photography but they may need to be modified after the cruise. The computer program Assisi is used to expand the data collected at the sample points to the entire forest.

The plan is developed using data gathered during the forest inventory along with field observations and notes made during the field work.

4.2 Mapping

From an operational and planning standpoint maps are very important tool for both the forester and a logging contractor. Weare forestland maps are computer generated and include many features found on the landscape including: roads and trails, streams and water bodies, timber types, soil types, topography and abutter information.

4.3 Boundaries

Boundary establishment and maintenance is a critically important and commonly overlooked aspect of land ownership. Region-wide, many timber trespasses have occurred when the boundaries could not be located. On an ownership wide basis, the condition of the boundary lines vary from non-existent to freshly blazed and painted. Once a line is established it should be re-blazed and painted every 10-15 years. The Town should invest in signs that can be posted at every parcel corner and where boundary lines follow roads or trails. Re-establishment by engaging a surveyor is costly and it can be avoided through periodic maintenance.

4.4 Management Goals

All management of the forest that involves manipulating the vegetation found there will be guided by the following 4 concepts:

4.4.1 Species Composition

Tree species differ in their tolerance to and requirements of the environment, resulting in differentiating distribution patterns along environmental gradients. As a result, community composition and structure varies along these gradients. Management on Weare forestlands will strive to maintain natural species composition of those species best suited to each site. Determination of natural community types helps identify desired species composition.

4.4.2 Age Class Distribution

Well-balanced age classes provide a diversity of forest types better able to withstand the diversity of natural disturbances that can affect forests in New England. Well-balanced age class forest systems can also provide a continuous source of income from sustainable harvesting. The Weare forests are dominated by an aging overstory averaging around 80 years old, and including some areas of younger trees, and a few areas likely older, but is mainly an even-aged forest. The majority of the forestland here got its start at the abandonment of agriculture earlier last century, as with many forests of New England. In addition, much of the forestland has been harvested in multiple times over the years. One long-term goal of management here will be to better balance the forest structure, providing a multitude of age classes better able to withstand widespread disturbance such as diseases and ice storms, support a diversity of wildlife habitat, and provide a sustainable timber resource.

4.4.3 Coarse Woody Debris

Coarse woody debris includes down trees and dead and dying standing trees, and cavity trees. It tends to be the first thing private landowners want to “clean” out of their forest. But, it is an invaluable component to the forest, providing habitat for many animals, insects, birds, microorganisms, and many plants including mosses and liverworts. According *Biodiversity in the Forests of Maine* coarse woody debris provide important “shelter, resting, nesting, denning, foraging, perching, displaying, and basking sites for 20 percent of bird, 50 percent of mammal, 44 percent of amphibian,, and 58 percent of reptile species (in Maine)”. New Hampshire may have slightly different percentages, but coarse woody debris here plays an equally important role in sustaining many kinds of wildlife. In addition, coarse woody debris contributes substantially to energy flows and nutrient cycling as it decomposes on the forest floor. And, it can enhance water quality and limit soil erosion. Coarse woody debris management will have a high priority on the Weare Forestlands.

4.4.4 Soil Productivity

Soils support forest ecosystems. Soils provide nutrients, harbor a water resource, and provide a growing substrate for trees, shrubs and plants. They also support macroinvertibrates and microorganisms (including important soil fungi and bacteria that help both to keep plants and animals healthy and decompose forest litter including wildlife remains). A forest site typically is classified by its soil type, including their depth, fertility, ability to hold water, and drainage class. Different forest "types" grow on different soil types. Aspect (which influences amount and intensity of direct sunlight) and topography or terrain also plays a role, but soils are the dominant factor. Soils need to be protected to the maximum extent possible during any activity in the forest from hiking to a timber harvest. Soils need to be protected from compaction, erosion, and unnecessary leaching. Organic material protects and helps to build soils up. But soil fertility is also greatly influenced by the bedrock on which it was formed. Generally speaking New Hampshire has more acidic soils due the large amount of granite rock as compared to Vermont, with her richer soils on top of more calcium rich bedrock.
Some soil protection strategies from the book *Biodiversity in the Forests of Maine*[7] for Weare's Forestland include:

Forest soils, forest floor and Site Productivity:

- Avoid whole-tree removal, particularly on low-fertility sites (i.e., shallow to bedrock soils, coarse sands, wetlands, and area with high water tables), unless replacement of nutrients and organic matter is considered
- Conduct harvest operations during the season of the year that is most appropriate for the site. Operating on snow or frozen ground, whenever possible, minimizes effects of the soils and forest floor.
- Choose harvest equipment to suit the site and minimize disturbance. For example, in dry conditions, and in some wet conditions, consider using tracked vehicles to reduce rutting.
- Minimize skid-trail width using techniques such as bumper trees when appropriate.
- Establish skid trails that follow land contours where possible rather than directed straight uphill.
- When possible, conduct whole-tree harvests of hardwoods during dormant leaf-off season to retain nutrients on site.
- Avoid or minimize practices that disturb the forest floor, remove the organic soil or cover it with mineral soils, except as necessary to accomplish silvicultural goals and to regenerate certain tree species.

4.4.5 Water Resource Protection

Water resource protection is an important principles and management objective on Weare Forestlands. A large amount of the forestland is neighboring wetland habitats that

[7] Soil management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

provide drinking water to the people of Weare. Forest management activities, if done to the best of our ability, should enhance water quality rather than degrade it.

Some water protection strategies from the book *Biodiversity in the Forests of Maine*[8] for Weare's Forestland include:

Riparian and Stream Ecosystems:

- Establish riparian management zones along streams, rivers, ponds, and lakes. These are not intended as no-harvest zones. Forest management systems, such as single-tree or small-group selections cuts, that retain relatively continuous forest cover in riparian areas (65-70 percent canopy cover) can help maintain biodiversity by protecting water quality, providing shade, supplying downed woody material and litter, and maintaining riparian wildlife habitat conditions.
- No-cut zones of 16 to 100 feet are recommended by several management guides on river or pond shores containing wet seeps, shallow or poorly drained soils, or area with slopes greater than 8 percent. Limited single-tree cutting can occur on other sites within this zone, with cabling from outside the zone suggested.
- Consider management at the watershed-level as an approach to avoiding stream channel degradation from excessive runoff.
- Road construction, stream crossings, skid trails, log landings, and all phases of timber-harvesting operations should conform to Best Management Practices

Springs and seeps:

- Avoid leaving slash in woodland seeps, springs, or associate wildlife trails.
- To the extent feasible, avoid interruption groundwater flow above or below seeps and above springs. When seeps and springs can't be avoided, minimize flow interruption by strictly adhering to appropriate Best Management Practices for water crossings.
- Where feasible, use woodland seeps and springs as nuclei for uncut patches to retain snags, cavity trees, and other site-specific features.

5 Timber Management Considerations

5.1 General Silvicultural Techniques and Goals

The forest as a revenue resource is best managed as a long-term investment with steady, predictable returns where possible. Timber fits in this scheme, as high quality trees take decades to grow. On Weare forestland silvicultural approaches will vary based on what the forest needs, but the long-term goal is to provide a sustainable return. Timber products will be the main revenue generator but non-timber resources should be evaluated as opportunities arise. From a timber standpoint, management will focus on tree quality and quality development as opposed to just growing "fiber". Initially, stand treatments will likely focus on up-grading the overall quality and the long-term potential. On some acres this may involve the release of existing high quality crop trees while on other acres it

[8] Soil management recommendations from the publication Biodiversity in the Forests of Maine; Flatebro, Gro, Foss, Carol, and Pelletier, Steven, 1999, UMCE Bulletin #7147

may involve establishing a new stand of trees. The approaches will utilize both even-age an multiple-age techniques with the latter being preferred. Regardless of the approach, any cuttings will be geared to condition the stands by enhancing individual tree vigor and health through the removal of low quality trees and trees which are not naturally well suited for the sites they are growing on. Availability of appropriate markets and loggers willing to do this kind of work are fundamental to this type of management strategy.

The primary management unit for Weare forestland is the individual stand. A forest "stand" is an area of land delineated by the type, age, and amount of trees growing there, the site characteristics, and often the natural community type. Stands differ from one another in species composition, density and often age. Stand differences occur due to soil conditions, aspect, disturbance patters, and most commonly past land use. Stand level planning allows similar areas of forest to be managed based on their specific conditions. When working in a stand, foresters work on the tree level, typically evaluating individual tree conditions in relation to the management goals for the stand.

Based on information collected during the timber inventory, from aerial photo interpretation, and from ground truthing, the forest is divided into forest stands. This may or may not correspond to an area's existing natural communities, but ideally will result in stands based on natural community type. A description of each stand and a chart describing its characteristics can be found in the data section of the plan for each property. The location of each stand can be quickly identified by looking at the forest type map included in those plans. Wetland and open or semi-open land types exist on many properties as well and typically are delineated as individual stands.

Management on Weare forestland will utilize a combination of silvicultural techniques that typically are separated into two general categories, even-age and unevenaged management. Evenaged management methods include clear-cut, seed tree, shelterwood, overstory removal and patch cut applications and may be used to regenerate a new stand when deemed necessary. Unevenaged management methods generally include single tree and group selection used to regenerate small areas resulting in uneven age classes in a given stand. Often though, applied techniques fall somewhere in between these two text-book defined categories. One may define a large group opening (unevenage management) as a small clear-cut (evenaged management). Improvement thinnings often fall somewhere in between as well, depending on the intended results and the actual results. A thinning may result in improved growth of the overstory trees, an even-aged treatment. A thinning may also provide similar conditions as single tree selection, a unevenaged technique, and result in regeneration of shade-tolerant species. Crop tree release, a commonly utilized management technique, falls somewhere in between evenaged and unevenaged. Given the variability of site quality

and stocking, even within a defined stand, unless evenaged management is specifically called for, management typically will fall in the unevenage category.

Further discussion of unevenage management is required. Traditionally, the intent of unevenage management is to attain forest stocking conditions that mimic the “inverse-J curve” diameter/age distribution, basically many small young stems and fewer larger, older stems. Practicably speaking, unevenage management based on the inverse-J curve is difficult to carry out. Often, a simpler form of multiple-age management is utilized that results in the introduction of a new age-class on a portion of a stand each harvest entry. The amount of area that is regenerated can, and should, be geared towards creating a balanced and sustainable age class distribution. Given the even-aged condition of the majority of land in New England, encouraging multiple age classes is a more attainable, practicable goal and in effect, a more desirable goal. To clarify silvicultural discussion of management technique, the term multiple-age management will replace the more traditional uneven-aged management term, but will utilize the same silvicultural techniques including single tree and group selection.

The following silvicultural treatments will be most commonly applied on Weare forestland:

Individual Tree/Group Selection: A common silvicultural treatment designed to produce a multiple aged stand structure. Trees are harvested in groups from a few individuals to up to ½ acre opening, to secure regeneration of a wide array of species but primarily shade tolerant and mid-tolerant species. Between the groups, single tree selection is applied to regenerate shade tolerant species. Typically trees that are targeted for removal are diseased, damaged, or mature. This treatment is well suited to almost all timber types but it is most commonly applied to northern hardwood and spruce fir. When applied over time in the same stand, this should result in a multiple-aged stand.

Shelterwood with reserves: A silvicultural treatment designed to regenerate a desired species, such as white pine or red oak. This is an even age treatment, however some trees will be left in perpetuity for aesthetic and wildlife habitat concerns. This treatment is commonly applied when trying to regenerate white pine, red oak, and northern hardwood on their respective sites. This treatment can be done 2 or 3 steps (removing a portion of the overstory during each step, or entry) depending on the response of the regeneration.

Patch cut: A silvicultural treatment designed for regenerating intolerant and mid-tolerant species. It is commonly applied in hardwoods when the overstory is in poor health or the majority of the trees will not make it until the next scheduled treatment. In spruce fir stands it is commonly applied when advanced regeneration is present and it is being over topped by mature trees. It is often applied with the intent of creating a mosaic of patches within a stand. The effect is to create an uneven age stand consisting of

small even age patches. If a 1/4 of a particular stand treated in this manner then after 4 entries there should be 4 age classes of trees. Patches can range from 1/2 an acre to about 3 acres in size. Thinning in between the patches may or may not be done as individual situations warrant.

Improvement Cutting: An intermediate silvicultural treatment designed to up grade the overall stand quality. This treatment can be applied in even or un-even aged management regimes with future cuttings determining stand structure. This technique is best applied in stands of low quality which in most cases have been high-graded in the past.

Thinning: An intermediate treatment in high quality stands designed to give competing trees more space to grow. The goal here is to adjust stocking levels to increase growth and vigor of the best trees. Some good quality trees are often cut. As with improvement cutting, this treatment can be applied in both even and un-even age regimes. Regeneration is not really a concern at this stage.

Crop tree release: A common silvicultural treatment used to free high quality growing stock trees from trees competing for the same space. The selected “crop tree” is flagged and released from competition on tow to preferably three sides. Crop tree release typically occurs between other treatment types, such as group selection or patch cutting. It also can be utilized as a stand thinning method when on average fifty to seventy trees per acre are released. This amount varies according to stand types. Some species require special attention. For example, sugar maple typically will sprout small buds on the main stem (called “epicormic sprouting” when the previously shaded stem is suddenly exposed to sunlight after being released. To prevent this sprouting, which greatly reduces the timber quality of the stem, sugar maples should not be released on the south side. Leaving low shade, such as understory hemlock to shade the stem helps as well. Red oak is another species in which epicormic sprouting is a concern.

5.2 Cover Types

The following cover type designations are used to differentiate forest types:

COVER TYPES
H ≥ 50% dominant & co-dominant trees are hardwood
S ≥ 50% dominant & co-dominant trees are softwood
HS = Mixed species but dominated by hardwood
SH = Mixed species but dominated by softwood
(in some instances a dominant species, such as WP or HE may be included)

SIZE CLASS
1 = Seedlings or regeneration - 90% of stems < 3" DBH

2 = Saplings or small poles 3" - 8" DBH
3 = Large poles and or small sawtimber 9" - 12" DBH
4 = Sawtimber 13" and larger

CROWN CLOSURE/DENSITY
A = 75-100% crown closure of co-dominant or dominant trees
B = 50-74% crown closure of co-dominant or dominant trees
C = 0-49% crown closure of co-dominant or dominant trees

5.3 Growth Rates and Allowable Cut

An in-depth study of tree growth is beyond the scope of this plan. However, increment cores can be taken to age stands and to get a general idea (not statistically quantitative) of growth trends in particular stands if warranted. As with any diverse land holding the growth rates vary widely from the slow growing sites typically found at the height of land to the more productive sites found at the base of slopes. The average unmanaged woodlot in New England grows at a rate of 2 to 4 percent per year in volume. This corresponds to growth rates of approximately 0.5 cords or 250 board feet per acre per year. Likely Weare forestland falls somewhere in this range. The growth is somewhat better in areas dominated by younger trees, as young trees tend to grow at a faster rate than older trees. Through management, the annual growth rates on individual trees will increase; however little can be done to improve the site conditions except to allow tree nutrients to recycle into the soil and to strive to encourage those species which are best adapted to the specific sites on which they are growing.

From an economic standpoint, it is important to shift the growth from poor quality, low value trees to trees of higher quality where such growing stock exists. A simplified way to think of growth and how individual trees can grow at a faster rate is to look at a single acre of land. Every acre is capable of producing a specific amount of biomass or fiber, determined by soil properties, species composition, moisture & temperature regimes, and aspect. Removing trees through timber harvesting results in improved growth on the residual trees. The growth potential of the acre of land is shifted from many trees to fewer selected trees.

Sustainable harvesting requires knowing how much you can cut per year on a landbase without depleting the resource. Sustainable harvesting means not cutting more than the forest is growing. This amount is typically called the “allowable annual cut”. There are several methods one can use to calculate the allowable cut. The first method is to use an average growth rate. Weare forestland is of average quality, and therefore likely grows around 3% per year. Another way of estimating growth is the long used “½ per cord per acre per year” figure coupled with an average of 500 board feet per cord. A third way of looking at it is through an area regulation model. Based on a X year cutting cycle and number of acres of forestland available for timber harvest.

All 3 methods give a ballpark figure of sustainable timber harvest estimates. Conservative, natural disturbance-based silviculture and a 15-20 year average cutting cycle should maintain harvests that are well within the sustainability estimates.

5.4 Tree Quality and Tree Health

With a diverse ownership tree quality is quite variable. In general, tree quality ranges from good to poor. There are high value trees throughout the ownership, and there is ample value to successfully manage these lands, but nowhere on Weare forestland is a stand fully stocked with high quality timber. At the same time it can be said there are stands fully stocked with poor quality timber. Continued access to low grade markets will be necessary to economically upgrade stand quality. It will be necessary in some stands to carry out some non-commercial improvement work. This is work where a stand is thinned, but there is no value in removing the cut trees. They are left in the forest to decompose. This work may be combined with a commercial timber sale, or done alone and paid on a per-acre or similar rate.

Tree health is also variable throughout Weare's ownership, but in general is good. It will be more specifically addressed in the individual tract management plans. There are no serious outbreaks of insect or disease occurrences outside of typical forest health issues. There are certain to be problems over the years on a large-diverse ownership. Wind events which involve tree blowdown and ice-storms will probably be the most common tree health issue. Serious exotic insect pests such as the hemlock wooly adelgid and the emerald ash borer will certainly have to be monitored. Things beyond our control such as atmospheric deposition and global warming are sure to play a role in the future.

6 Harvest Administration

6.1 Pre-Harvest Plan

Prior to timber harvesting a pre-harvest plan will be drafted describing specific harvest boundaries, silviculture, access and operations.

6.2 Access

Access for logging typically is a challenge for most landowners. It is not only internal access that needs improvement; some town roads are inadequate for modern log hauling trucks. Almost every logging job requires some form of earth work ranging from the installation of a culvert to major truck road construction. To take advantage of the wide range of markets available and to sell forest products in a cost effective manner efficiency is fundamental to success. The logging contractor needs to have a

place to process, sort and load the wood that is dry, flat and large enough to stockpile up to 10 different products.

Planning an access system is done during the formation of the individual management plans. Where possible, historical access points are used. Right-of-way issues commonly need to be dealt with at this time. Due to topographic features, some of the properties may require access through other landowners.

The goal of successful, efficient access is to build the smallest, lowest impact road that accomplishes the job. Roads are designed to last for many years as most will be used at least once every 15 years. During construction, erosion control measures will be in place at all times and all exposed areas will be seeded and stabilized in a prompt manner. As a general rule, culverts will be plastic and will be slightly oversized for the application. This aids in clean out and in times of high flow. Gates, cables or structural impediments may be used to control access points.

Maintenance of road and landing areas is important for continued utility. Keeping landings open and roadways clear of debris and cut back will be an ongoing project. On smaller roads this needs to be done every 5 years. For the larger roads, especially those in steep terrain, yearly visits will include culvert inspection and clean out, and an evaluation of erosion control structures.

Ownership-wide, a good network of roads is important from several standpoints. Forest products markets are finicky and the demand for a particular product can skyrocket almost over night. Quick access is also advantageous to get a jump on any salvage or monitoring activity that may be necessary following natural events such as ice storms, strong wind occurrences, insect infestations, or fire. Road construction takes time and money but a well thought out and well maintained road system will allow Weare to respond quickly if necessary.

6.3 Operability

Very little of the ownership is not currently accessible or available for logging at any level. This includes land that is too steep, reserve areas, wetlands and other spots that are environmentally sensitive. Areas that contain rare or endangered species would also be considered off limits during the time that the occurrence exists. Steep ledgy areas that could conceivably be operated by equipment may be considered inoperable due to shallow soils and the relatively low productivity for trees on those sites.

6.4 Forest Products Marketing

Regionally, Weare is well situated to take advantage of a multitude of options in the marketing of forest products. Today's markets change so quickly it isn't prudent to summarize them in a 10-year

document. Several good resources with information on markets exist including the New Hampshire based Sawlog Bulletin published by Log Street Publishers out of Littleton, NH and the Northern Logger magazine out of Old Forge, NY. The best option is to work with a forester who knows and works with the current markets. Forest products from Weare typically will go to local mills whenever possible, but may also go to regional areas including Canada.

6.5 Sales Contracts

Timber sales contracts are important and necessary documents that protect the landowner's interests. They should clearly identify what's to be done, by whom, for what cost, and by what date. The Town of Weare should carefully review all contracts and get a second opinion if possible prior to signing.

6.6 Harvest Monitoring

Successful timber sale operations require frequent and consistent monitoring to check quality of the work, conditions of the roads, woods, and landings, and proper utilization of the products. In addition, frequent communication with the contractor tends to prevent possible problems. The job size and level of complication will determine the proper level of monitoring, but typically all jobs are checked at least once a week by the forester.

7 Harvesting Methods

7.1 Local Logging Capacity

Having logging contractors that are capable and willing to do professional careful work is a challenge. Weare must look for contractors who are honest, take pride in their work, have the right equipment for the job and enjoy working in the woods. Participation in logger training such as "the game of logging" or professional certification is encouraged. With equipment costs, and insurance rates very high making a good living is a balancing act for many loggers. Prices for pulpwood and other low-grade products have not really changed in 15 years while all the costs have escalated. The only way loggers can make money cutting pulpwood is through increases in production levels. Loggers are going to need incentives to upgrade their equipment and their skills, while maintaining high standards in the woods. It is becoming more difficult to find good woods workers, especially younger ones which has important implications for carrying out jobs in the future.

Weare and the forest manager need to continually develop relationships with contractors who are capable and are looking for steady long-term work. Logging rates need to be set in such away that the contractor can make a decent living while maintaining high standards.

Several different methods of logging are available to accomplish Weare forestry goals. A successful outcome to a job is dependent on proper planning. One aspect of good planning includes matching the logger and his or her equipment to the particular job. Equipment for logging jobs range widely and there are positive and negative attribute to any logging system.

Currently, the most common type of logging involves the use of rubber tired cable skidders pulling trees that are cut with chainsaws. This equipment is able to work on fairly steep rugged ground with little difficulty. Large diameter trees are not a problem for well-powered skidders. A properly planned job can leave the forest appropriately stocked as a skidder can maneuver quite well. There are however some down sides to this method. The skidder operators have to be both highly trained and conscientious. A skidder can do a lot of damage to a forest in a short amount of time. Skidders can have an impact on soils if they are not operating at the right time of year. Soil compaction and soil rutting have detrimental impacts on long-term soil productivity.

In the past 5 years, so called mechanized logging has become more common place in this region. Mechanical tree harvesters cut the trees instead of a chainsaw. The harvester is commonly on tracks, similar to an excavator. The machine has a harvesting saw-head mounted on a boom with a fifteen to twenty foot reach. Trees are cut and placed in bunches and are then dragged to the landing area by either grapple or cable skidders. This logging system has several benefits, most of which involve the mechanical harvester. The harvester has the ability to cut a tree, carry it, and place it anywhere. The trees are generally placed in bundles in a skid trail avoiding damage to the trees left behind. A good harvester operator can cut enough trees to keep two or more skidders busy. As long as the harvester operator is skilled, the skidder operators can do their job with minimal damage to the residual trees. This system of logging is capable of producing a tremendous volume of wood in a short amount of time. This may or may not be good, depending on the objectives. All the soil compaction issues raised above are valid here as well.

So called low-impact logging methods involve the use of animals, small, skidders, bulldozers, or forwarders. The first two are slow, and they can not economically drag wood very far. They can work on very steep slopes however. A forwarder is a skidder-like piece of equipment that carries the trees out of the woods rather than dragging them. There is less ground pressure applied so soil compaction can be kept to a minimum. The forwarder is very maneuverable and it can work in very tight spaces. This logging method is often called a cut -to-length system because the trees are processed where they lie. The cut up wood is then loaded onto the forwarder. When it heads to the landing it is not dragging seventy feet of tree behind it. Forwarders work best on forgiving ground and are not well suited to steep or rocky ground. Forwarders have the ability to carry the wood quite a distance, and they require

minimal landing space. The relatively high cost of this logging system could be offset by lower road construction costs.

New equipment for logging is always being developed. The push towards an ecosystem approach to forest management will result in the design of more environmentally friendly logging equipment. High flotation tires, tracked equipment and biodegradable hydraulic and chainsaw oils are examples. Low impact logging results in a healthier and more productive forest and should always be strived for.

7.2 Forest Products Utilization

Any time a tree is cut, it is important that the tree is utilized in such a way that the most value is derived from it. The first step in proper utilization is knowing the markets and the end uses for the wood. Specifications for forest products can vary widely from one mill to the next. Furthermore, product specifications are constantly changing as mill utilization becomes better. Once a destination for a particular product is chosen, each tree needs to be carefully evaluated before it is cut. A mistake that turns a veneer log into a sawlog can be very costly, especially if it recurs throughout the job.

Traditional log and lumber grading rules, and poor product recovery at most mid to large sized sawmills presents a challenge to getting the most out of every tree. Most sawmills are heavily capitalized and are more concerned with production than quality. Many white pine mills for example would prefer to saw a 14 foot poor quality log than an 8 foot clear log. New markets are developing especially for certified forest product. Many involve small operators with relatively low overhead. Portable or stationary band sawmills can produce quality lumber from small diameter and or short logs. Secondary manufacturing such as flooring or molding or direct marketing of the product seems essential to maintain profitability for these operations.

With the exception of cut-to-length systems, most utilization decisions are made on the landing. A piece of equipment called the loader-slasher has become very common place with the advent of mechanized logging. The slasher portion is a circular saw which cuts the trees to length. The loader handles the tree and is capable of loading trucks and piling the tops of the trees to be chipped. This is a quick, economical way of processing the wood but it does have its drawbacks. The loader operator is quite a distance from the wood that is being sawn, thus high value logs may not be looked at and cut carefully enough. Sorting products is difficult and is often handled by a grapple skidder on larger jobs.

The more traditional method of bucking the trees involves the chainsaw. The trees are skidded to the landing, measured and cut by hand. The logger has more of an opportunity to look the entire tree over carefully. After the wood is cut, it is important to properly sort the wood by grade and product so the trucker’s job involves picking up the correct pile and trucking it to the mill.

An idea which may catch on is called optimization where wood is brought into a facility that makes the decisions. The tree-length wood is cut up to yield the highest value possible returning more

to the landowner and the logger. Some of these facilities can use short pieces of wood that traditional mills can not handle. An example is a six foot clear piece of sugar maple that could not be used because eight feet is the minimum length the mill could handle.

Marketing products as “green certified” (see latter discussion) to consumers who demand that their products come from a well managed sustainable forest is beginning to catch on and provide real returns to the landowner. Certification is something TEMCO can provide Weare with if so desired.

7.3 Social Climate

There are presently mixed feelings among the general public concerning forest management, and in particular, timber harvesting. While all people use forest products, most do not fully understand how they are produced. People's perceptions of what may be happening and what is actually occurring may be very different. A timber harvesting project designed for wildlife habitat improvement may involve small clear-cuts. Salvage cutting due to natural disasters may require heavy cutting including some patch clearcutting. The idea of clearcutting may upset people unless they find out it was done and planned purposefully and with scientific intent.

It is recommended Weare notify the public of pending logging and the reasons. Tours of the property for educational purposes can often create a lot of interest and dispel speculation. Explanations about why things are done a certain way may change the way people perceive forest management.

8 Forest Economics

8.1 Forest Value

Good land stewardship is expensive. Planning, forest inventory, wildlife habitat enhancement, road building and other improvements all cost money. Input from dedicated foresters who care about the land and have the same ethic as the landowner is invaluable. In well-managed forests these costs are often viewed as necessary capital investments or annual expenses to ensure future gains will be sustainable over the long haul.

Forests grow in value in three ways. *Physical growth* accounts for the gains in volume over time. The faster an individual tree grows, the faster the tree increases in value if it is of sufficient quality. The second way forests increase in value is through *product development*. As a sapling, a tree has no merchantable value. Pole timber can sometimes be marketed as firewood or pulpwood. Once the tree grows into the sawtimber size class, if it is of sufficient quality, it can be sold for sawlogs or veneer. The per-unit value increase from pulpwood to sawlogs to veneer is very large, in some cases,

1000% or more. It would be unwise from an economic standpoint to cut a pulpwood size tree that could eventually grow into a valuable sawlog. Furthermore; an individual tree growing rapidly into sawtimber size is a tree which has a high rate of return. The third way forests add, (or possibly lose) value, is through *relative price changes* in the values of various forest products.

The demand for forest products is cyclical, especially for low-value commodity items such as pulpwood and chipwood. The low grade markets seem poised for a change mostly due to the looming shortage of and shifting from fossil fuels. Many facilities are looking to wood as a source of energy in many different forms (chips for electricity, firewood, pellets, and possible ethanol). Demand for paper and the price are highly volatile much of which is related to the relative strength or weakness of the dollar. Domestic demand for higher quality products is strongly related to housing starts which seems to cycle from boom to bust. Commodity items such as spruce & fir for framing and pine for windows, doors & trim are tied the most to housing while hardwood lumber & veneer for furniture and cabinets are some what less volatile and they can be exported overseas. The big change for the forest products industry since 2000 or so is the shift to a global economy. Much of this nations furniture and cabinets are now made in China for example. Wood that used to be sourced in the U.S. now comes from regions closer to China. Much of the wood used is of a suspicious origin, some of it harvested illegally, and some harvested in a non-sustainable and environmentally questionable manner. The good news is that while preferences and products are constantly changing, world-wide there is an increasing demand for forest products while the land base from which the products are obtained is shrinking. This bodes well for patient long-term owners of forest land

8.2 Timber Tax

Any time timber is cut in the State of New Hampshire, a timber tax is assessed by the Town where the wood is being cut. The tax is roughly 10% of the stumpage value, though it varies by species. Often expenses related to harvesting timber, i.e., road or bridge building, are overlooked when the tax is levied. A road account needs to be established at the time of construction. Road costs can be spread out over the amount of timber accessed to lower the timber tax burden.

9 Laws and Required Permits

9.1 State and Town Laws, Town Policy

The State of New Hampshire has laws pertaining to the harvesting of wood which must be followed, including water quality laws. New Hampshire has defined what it calls Best Management Practices for logging jobs or BMP's. BMP's will be followed in all logging operations. The BMP's and other pertinent topics are described in the recent publication "Good Forestry in the Granite State".

9.2 Water Quality Protection

Any time heavy equipment is used in the woods there is the potential for water quality problems. Skid trails in the wrong place or used during the wrong time of the year can cause erosion and related sedimentation problems. To avoid water quality problems, proper planning is critical. The timing of the job is the most important factor in maintaining water quality. Access roads and skid trails should be properly laid out initially by either the forester or the logging contractor.

Buffer zones along reservoirs, ponds, bogs and other riparian areas will not be encroached upon. A predetermined buffer width will be avoided for planning purposes because this simply does not work as well as using on-site indicators to determine adequate buffer width. Things such as topography, a distinctive change in forest cover type, evidence of wildlife travel corridors or concentration areas for wildlife, recreational use and aesthetic concerns will all be used to evaluate appropriate buffer widths and locations. Depending on the situation some thoughtful and sensitive individual tree harvesting may be done within buffers to encourage a diverse forest structure.

After any logging, waterbars and other drainage control structures will be installed. Landing areas or places of exposed soil will be seeded; mulch hay may also be required. All brook crossings will be properly restored with the banks mulched and seeded. The most effective safeguard is a careful equipment operator with common sense.

Special consideration needs to be given during construction of new or upgrading of old truck roads. When soils are recently exposed, they are vulnerable to erosion and soil movement. Stabilization needs to take place as soon as possible to limit soil movement. The forester needs to be on site frequently when such construction takes place to direct the work. Monitoring is done when a logging job is being conducted as well as follow up visit to the site.

It is likely impossible to have zero impact on temporary water quality as untimely weather events happen. The goal is to minimize these impacts during a job, and to virtually eliminate them at job closure by following BMP's, common sense and frequent monitoring.

10 Non-timber Forest Resources

10.1 Cultural Features

Common cultural features include old cellar holes, wells, barn foundations, cemeteries, and stone walls. When encountered they are mapped and investigated. These are very important historical structures. They provide some incite to the cultures of earlier societies.

Any management activity i.e.(logging, trail building, wildlife habitat management or aesthetic work) should be done without disturbing the historical evidence of earlier societies. All management planning will include the protection of any known sites.

10.2 Educational Opportunities

Weare has the opportunity to host educational tours to teach others the benefits of good forest management. It is recommended that a public workshop be offered when a timber harvest is done. The workshops can vary, some may to focus on the job set-up and be presented at the beginning of the job. Others may be given mid-harvest to show a job in operation. Others may focus on opportunities to create or improve recreational opportunities through timber harvesting. Still others may focus on the infinite possibilities of improving wildlife habitat. Providing many and varied workshop opportunities will reach the largest amount of people. When people understand what forest management is actually about they are much less apt to object, and hopefully are prompted to provide meaningful and constructive feedback.

10.3 Recreation Opportunities

Recreational use on the forest is as varied as the individual tracts. Hunting and snowmobiling are probably the most common uses. Mountain biking, cross country skiing, hiking, nature walking, shooting, ATV use, snowshoeing and horse back riding all occur in varying amounts. The individual management plans will address recreational opportunities and concerns for each tract. In general, low-impact uses will be encouraged and high-impact use, such as motorized recreation will be thoughtfully addressed. Weare has worked closely with recreational and sporting groups to see that their needs are met while keeping the health and function of the forest ecosystem in tact.

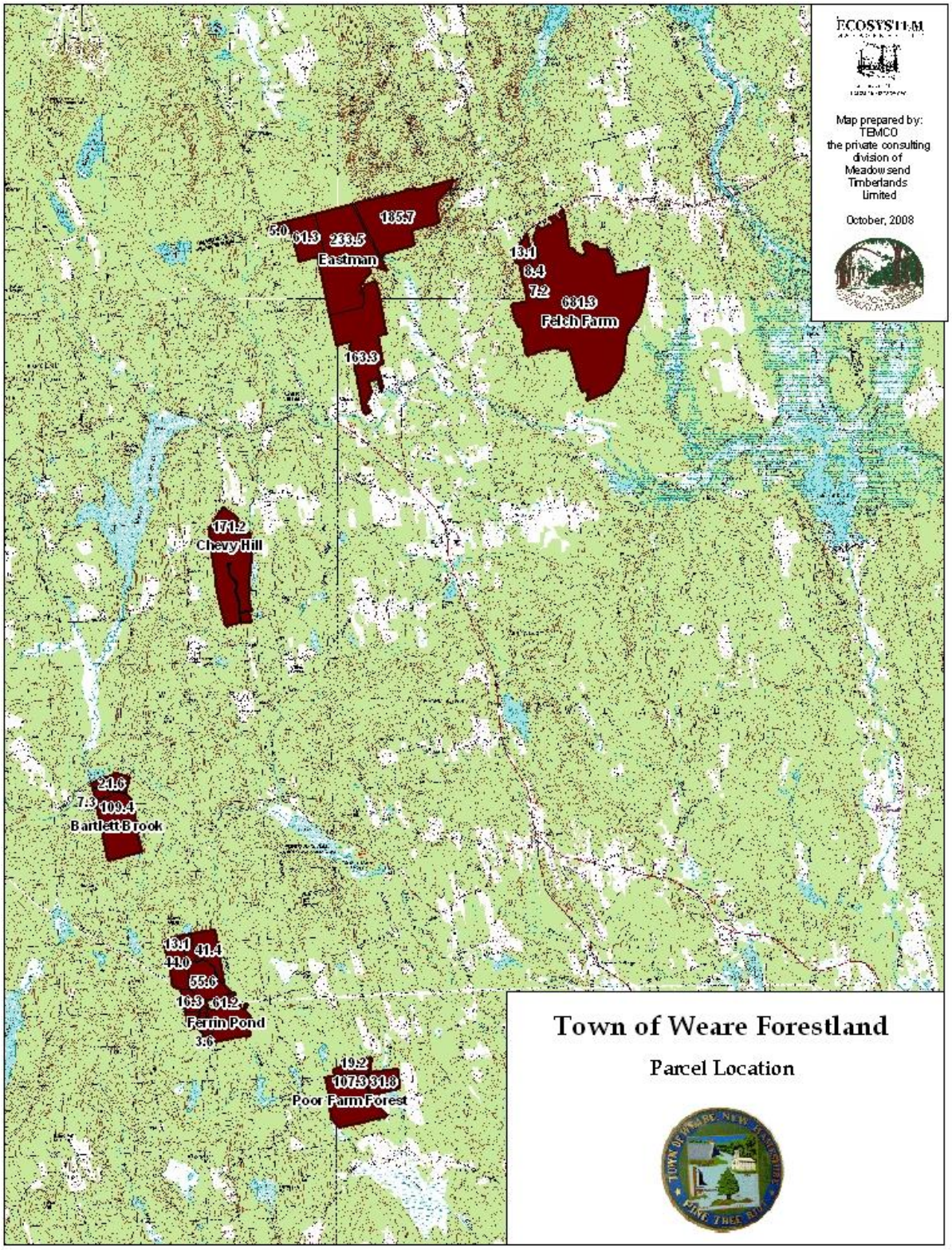
10.4 Aesthetics

The aesthetics and visual quality of Weare forests are very important. In human terms, the woods are inherently a messy place; trees are often blown down or losing limbs and natural mortality creates snags. Slash reduction following logging, an ice storm or crop tree release operations is important to

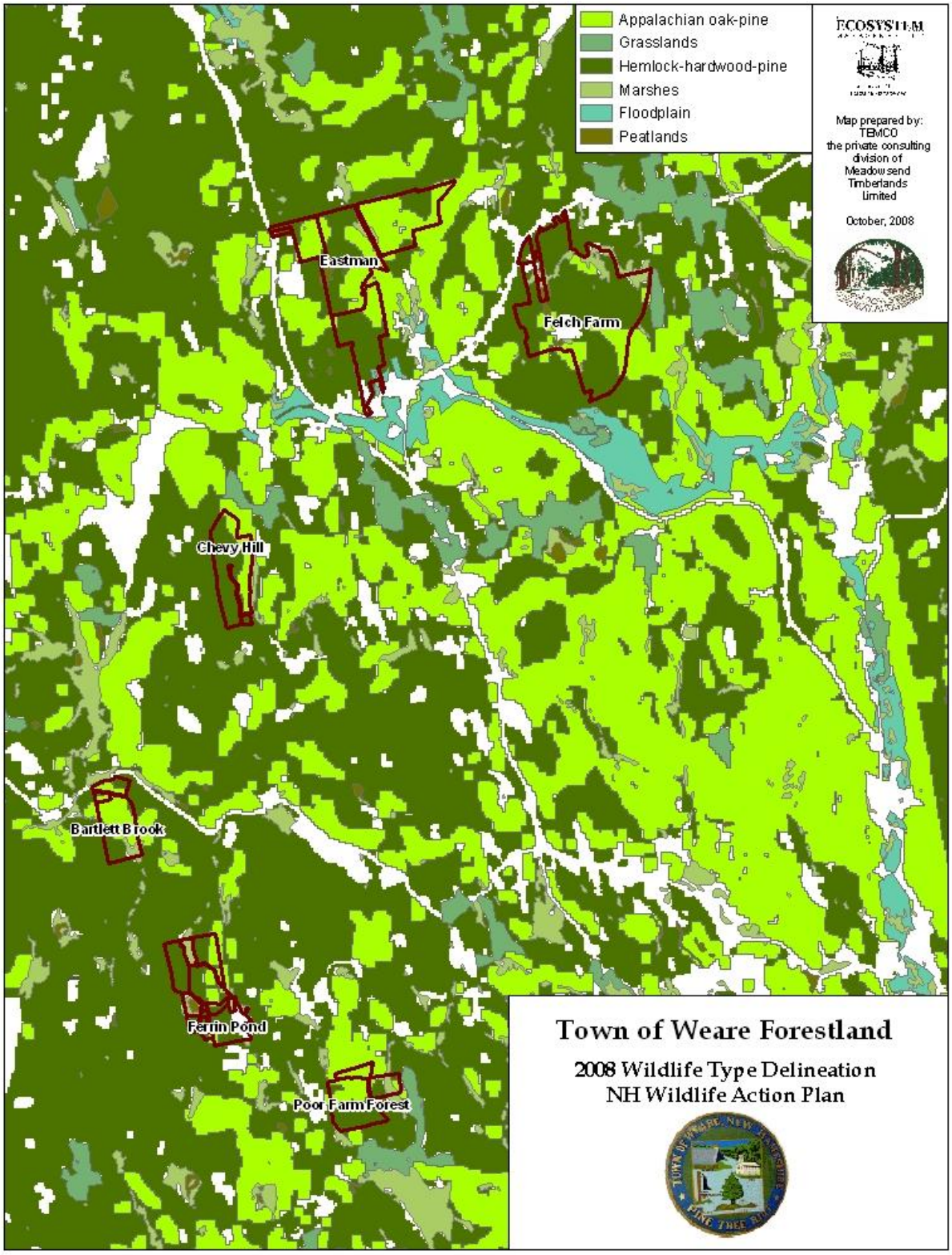
maintain the visual quality of areas close to roads and trails. Brush piles for wildlife cover could be built in areas which are not visually sensitive. Coarse woody debris or large pieces of trees can be left in areas not readily visible. Roads and trails should be designed so they are pleasing to the eye and fit into the natural landscape: poorly planned and constructed trails may lead to future eyesores. Proper cleanup of log landing areas is also very important. Debris left from logging operations can be very unsightly; it can be brought back into the woods, pushed off the edge or buried following landing use. In certain cases landings will be reclaimed by seeding and liming but in cases where erosion or immediate aesthetics are not a consideration they will be allowed to revegetate naturally.

While all of the approaches to aesthetic management take extra time, hence extra cost, it is well worth it the long run as they conform to owner objectives and good forest stewardship. Monies should be set aside for putting a logging job “to bed”. If the logging contractor is required to do this work it should be spelled out before hand so that the cost can be determined, and it is not left for the logger to do as an additional practice.

APPENDIX A: Parcel Location Map


ECOSYSTEM
Map prepared by:
TBMCO
the private consulting
division of
Meadowsend
Timberlands
Limited
October, 2008
185.7
5.0
61.3
233.5
Eastman
163.3
13.1
8.4
7.2
681.3
Felch Farm
171.2
Chevy Hill
21.6
7.3
109.4
Bartlett Brook
13.1
41.4
44.0
55.6
16.3
61.2
Ferrin Pond
3.6
19.2
107.3
31.8
Poor Farm Forest
Town of Weare Forestland
Parcel Location

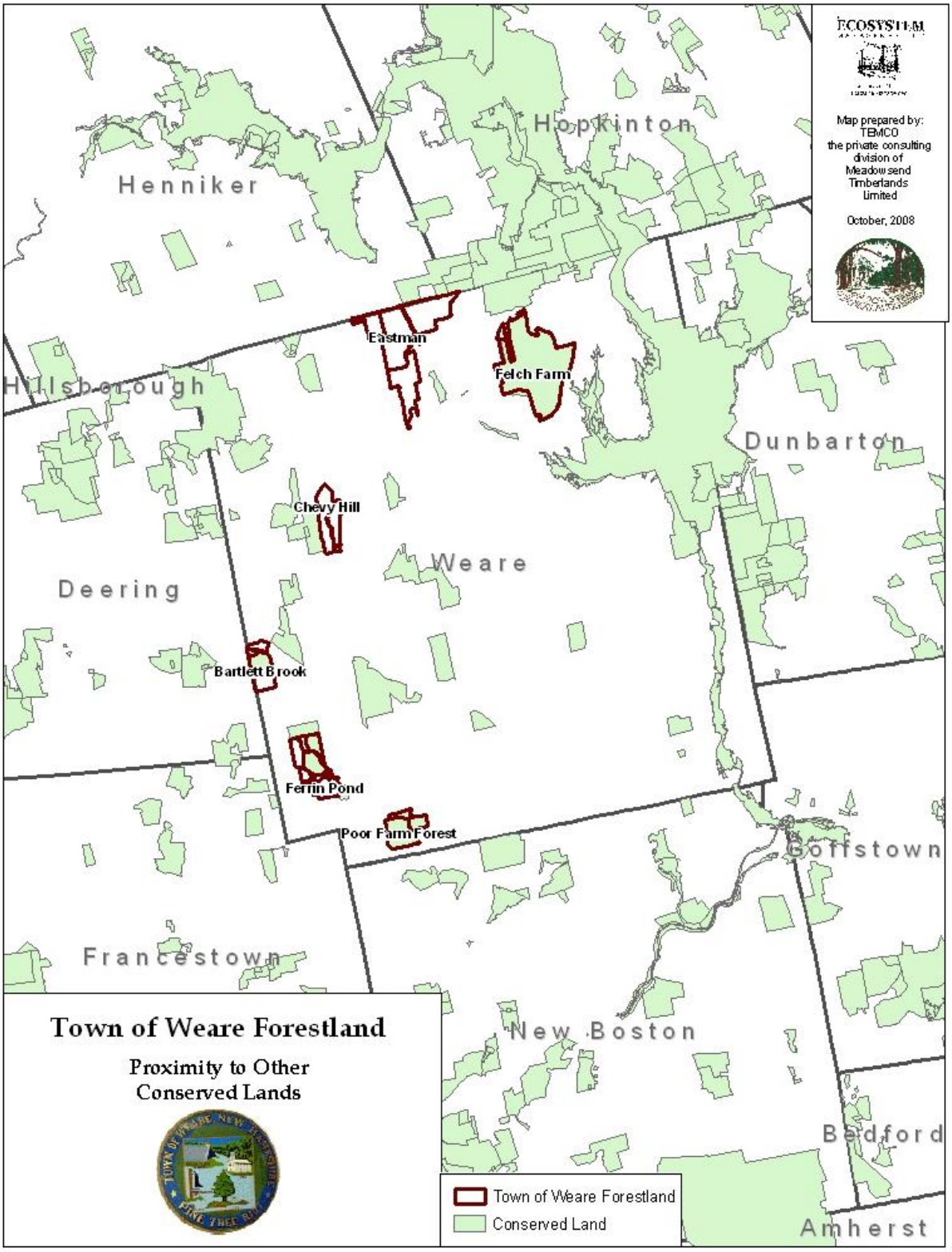
APPENDIX B: Wildlife Action Plan Type Descriptions


Appalachian oak-pine
Grasslands
Hemlock-hardwood-pine
Marshes
Floodplain
Peatlands
ECOSYSTEM
Map prepared by:
TBMCO
the private consulting
division of
Meadowsend
Timberlands
Limited
October, 2008
Eastman
Felch Farm
Chevy Hill
Bartlett Brook
Ferrin Pond
Poor Farm Forest
Town of Weare Forestland
2008 Wildlife Type Delineation
NH Wildlife Action Plan

APPENDIX C: Invasive Plant Identification and Control Techniques

APPENDIX D: NH Natural Heritage Records of Occurances and Town Lands Inventory

APPENDIX E: Proximity to Conserved Lands Map


ECOSYSTEM
Map prepared by:
TBMCO
the private consulting
division of
Meadowsend
Timberlands
Limited
October, 2008
Henniker
Hopkinton
Hillsborough
Dunbarton
Weare
Deering
Francestown
Goffstown
New Boston
Bedford
Amherst
Eastman
Felch Farm
Chevy Hill
Bartlett Brook
Ferrin Pond
Poor Farm Forest
Town of Weare Forestland
Proximity to Other
Conserved Lands
Town of Weare Forestland
Conserved Land